IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	10/551,251	Confirmation No. 1805
Applicant	:	ANANYA MUKHOPADHYAY	
Filed	:	March 26, 2004	
Title	:	A SYSTEM AND METHOD FOR ON-LINE PROPERTY PREDICTION FOR HOT ROLLED COIL IN A HOT STRIP MILL	
Group Art Unit	:	2121	
Examiner	:	Sunray Chang	
Customer No.	:	28289	

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office Action dated July 7, 2010, Applicant submits the following amendments and remarks. A one-month Petition for Extension of Time is being submitted herewith. Since November 7, 2010 fell on a Sunday, this response is timely filed on Monday, November 8, 2010.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 6 of this paper.

I hereby certify that this correspondence is being electronically submitted to the United States Patent and Trademark Office on November 8, 2010.

11/08/2010 Bruce L. White
Date Signature

Bruce L. White
Typed Name of Person Signing Certificate

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claims 1-12 (Cancelled).

Claim 13 (Currently Amended): A system for on-line display of property prediction for hot rolled coils in a hot strip mill comprising:

a unit for providing data on rolling schedule with chemistry from the steel making stage;

one or more field devices for measuring process parameters during hot rolling;

a programmable logic controller for acquiring data of measured parameters from said field devices and transmitting said data parameters to a processor;

means for converting the measured data from time domain~~, showing the results of the variation in speed of rolling and variation of header jet openings on a segment of the strip~~ to space domain~~, showing the finish rolling temperature for a segment using segment tracking by dividing a strip into segments and collecting process history data by tracking measured data for each segment at a plurality of points~~ using segment tracking, wherein a total length of a strip being rolled is divided into a plurality of segments, process history data are tracked and collected in each of the plurality of segments as ~~it~~the strip moves through the strip mill and ~~storing said~~ the process history data are stored as a segmental file;

a computation module for processing said segmental file for predicting mechanical properties along the length and through the thickness of the strip being rolled; and a display unit for displaying the average coiling temperature and a plurality of actual values of the coiling temperatures at any point over the length for comparison for determining accuracy and displaying predicted values for each segment, the values being one or more of a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation and nitrogen in solid solution/precipitate, so preventive and corrective action can be taken during rolling.

Claim 14 (Previously Presented): The system as claimed in claim 13, wherein said field devices include one or more of a pyrometer, a speedometer, a thickness gauge, and a solenoid valve for measuring data on process parameters.

Claim 15 (Previously Presented): The system as claimed in claim 13, wherein said programmable logic controller is a Westinghouse PLC 26 connected to said field devices through coaxial cable using remote I/O.

Claim 16 (Previously Presented): The system as claimed in claim 14, wherein said programmable logic controller is configured to capture data from said field devices over 0.01 sec. using WESTNET I data highway with Daisy Chain Network topology.

Claim 17 (Previously Presented): The system as claimed in claim 13, wherein said processor is an ALSTOM VXI 186 processor and the data transfer between said processor and said programmable logic controller is through WESTNET II using coaxial cable with Token Pass Network topology.

Claim 18 (Previously Presented): The system as claimed in claim 13, wherein said computation module includes a deformation sub-module for determining final austenite grain size after finish rolling.

Claim 19 (Previously Presented): The system as claimed in claim 13, wherein said computation module includes a thermal sub-module for determining the temperature drop during radiation while cooling said hot rolled strip.

Claim 20 (Previously Presented): The system as claimed in claim 13, wherein said computation module includes a microstructural sub-module for determining microstructural changes during phase transformation.

Claim 21 (Previously Presented): The system as claimed in claim 13, wherein said computation module includes a precipitation sub-module for determining an amount of aluminium nitrogen in a solid solution and in precipitates after cooling.

Claim 22 (Previously Presented): The system as claimed in claim 13, wherein said computation module includes a structural property correlation sub-module for calculating a yield strength, ultimate tensile strength and percentage elongation based on the phases present.

Claim 23 (Cancelled).

Claim 24 (Previously Presented): The system as claimed in claim 13, wherein the system includes a data warehousing device for storing the data generated by said computation module.

Claim 25 (Previously Presented): The system as claimed in claim 16, wherein said processor is an ALSTOM VXI 186 processor and the data transfer between said processor and said programmable logic controller is through WESTNET II using coaxial cable with Token Pass Network topology.

Claim 26 (Previously Presented): The system as claimed in claim 14, wherein said computation module includes a deformation sub-module for determining final austenite grain size after finish rolling.

Claim 27 (Previously Presented): The system as claimed in claim 18, wherein the system includes a display unit for displaying one or more of a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation and nitrogen in solid solution/precipitate.

Claim 28 (Previously Presented): The system as claimed in claim 16, wherein the system includes a display unit for displaying one or more of a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation and nitrogen in solid solution/precipitate.

Claim 29 (Previously Presented): The system as claimed in claim 19, wherein the system includes a data warehousing device for storing the data generated by said computation module.

Claim 30 (Previously Presented): The system as claimed in claim 23, wherein the system includes a data warehousing device for storing the data generated by said computation module.

Claim 31 (Currently Amended): A system for on-line display of property prediction for hot rolled coils in a multiple stand rolling mill comprising:

a unit for providing data on rolling schedule with chemistry from the steel making stage;

one or more field devices for measuring process parameters during hot rolling;

a programmable logic controller for acquiring data of measured parameters from said field devices and transmitting said data parameters to a processor;

means for converting the measured data from time domain~~, showing the results of the variation in speed of rolling and variation of header jet openings on a segment of the strip~~ to space domain~~, showing the finish rolling temperature for a segment using segment tracking by dividing a strip into segments and collecting process history data by tracking measured data for each segment at a plurality of points~~ using segment tracking, wherein a total length of a strip being rolled is divided into a plurality of segments, process history data are tracked and collected in each of the plurality of segments as ~~it~~the strip moves through the strip mill and ~~storing said~~the process history data are stored as a segmental file; and

a real-time computation module for processing said segmental file for predicting mechanical properties along the length and through the thickness of the strip being rolled; wherein, said predicted data on mechanical properties outputted from said computation module is stored in another unit for use by said scheduling unit at production planning and scheduling level.

REMARKS

Claims 13-22 and 24-31 are pending in this application, and claims 13 and 31 are in independent form. Claims 13-22 and 24-31 are rejected under 35 U.S.C. § 103(a) for obviousness over United States Patent No. 5,289,867 to Barker et al. (hereinafter "the Barker patent") in view of United States Patent No. 6,430,461 to Andorfer et al. (hereinafter "the Andorfer patent") and further in view of United States Patent No. 5,770,832 to Carnes et al. (hereinafter "the Carnes patent"). Claims 13 and 31 are amended. Support for the amendment can be found in the specification at paragraphs [0030] and [0031]. No new matter has been entered.

As defined by amended independent claim 13, the present invention is directed to a system for on-line prediction of mechanical property characteristics for hot rolled coils in a hot strip mill. The system includes a unit providing data on a rolling schedule in addition to chemistry regarding the product in the steelmaking stage. The system further includes field devices for obtaining real-time measuring parameters of the hot rolled coils during the rolling process. The system further includes a means for converting the measured data from a time domain to a space domain where a total length of strip of metal being rolled is divided into segments, the process history data (i.e., variations in rolling and cooling parameters) are tracked and collected for each segment as the strip rolls though the mill, and that such data is stored as a segmental file. The system further includes a computation module that processes a segmental file and predicts yield strength, ultimate tensile strength, percentage elongation, of the hot rolled coils, the properties along the length and through the thickness of the strip being rolled, and displays the average coiling temperature and a plurality of actual values of the coiling temperatures at any point over the length for comparison for determining accuracy and displaying predicted values for each segment is provided so preventive and corrective action can be taken during rolling, the values displayed being one or more of a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation, and nitrogen in solid solution/precipitate.

The Cited Prior Art

The Andorfer patent refers to a process to estimate, in advance, the expected material properties for the complete strip and only enables deviations to be corrected in the subsequent step of the process. (Andorfer, Col. 3, ll. 46-49.) The Andorfer patent further utilizes time-temperature curves for heating, cooling, and deformation to determine changes for maintaining the required mechanical/technological material properties for the rolled product as a whole.

The Barker patent refers to a cooling system for use with a continuously rolled rod. The three-step process is ongoing and includes rod testing, comparison with historical data, and determination of new set points. (See Barker patent, Col. 7, ll. 57-64.)

None of the Prior Art Teaches or Suggests the System of Independent Claim 13

Claims 13-22 and 24-31 stand rejected under 35 U.S.C. § 103(a) for obviousness based upon the Barker patent in view of the Andorfer patent. In view of the above amendments and the following remarks, Applicant respectfully requests reconsideration of this rejection.

As set forth in independent claim 13, which has been amended in an effort to further prosecution, the "means for converting the measured data from a time domain to a space domain" requires that a strip of metal be divided into segments, that process history data (i.e., variations in rolling and cooling parameters) is tracked and collected, and that such data is stored as a segmental file. The segment tracking in the present invention is provided by dividing a total strip into a number of segments. Each segment is monitored in the system as it moves through the stand and the system is continually tracking measured data for each segment. The variability is a variation in speed of rolling and variation of header jet openings on a segment of the strip as a result of fluctuations in speed and header openings due to a need to control the finish rolling process effectuating changes throughout the entire rolling process.

The Andorfer patent, which is relied on to teach this limitation, fails to recite the segment tracking limitation as claimed because the various data curves are not based on data collected from different segments of the rolled product, but rather from the rolled product as a whole. The Andorfer patent only discusses time temperature curves for cooling, deformation, and heating. However, these curves are not related to segmentation of the strip

as they are only a tool for determining a simple relationship between temperature and time for the mechanical response. The Andorfer patent describes using the curves to determine mechanical properties in-between steps on the strip mill. Andorfer gives no teaching or suggestion that the rolling strip should be used for segment tracking as in the present invention, nor does Andorfer discuss segment tracking of the strip in connection with the curves. Applicant respectfully submits that the Andorfer patent does not teach or suggest such a system including a means for converting the measured data from a time domain to a space domain where a total length of the strip of metal being rolled is divided into segments, that process history data (i.e., variations in rolling and cooling parameters) is tracked and collected for each segment as the strip rolls though the mill, and that such data is stored as a segmental file. The Barker patent and the Carnes patent fail to cure this deficiency.

As stated previously, the Barker patent only describes performing calculations off-line during simulations on a computer with the results sent to a controller, but only in sequence between rods entering the system. (See the Barker patent, Col 14, ll. 67-68.) The Barker patent does not teach or suggest having segment tracking, nor any changes as the rod is rolling in the system. For the reasons stated hereinabove, Applicant believes that the subject matter of independent claim 13 is not rendered obvious by the Barker patent in view of the Andorfer patent and the Carnes patent. Reconsideration of the rejection of claim 13 is respectfully requested.

Claims 14-22 and 24-30 depend from and add further limitations to amended independent claim 13 (or a subsequent dependent claim) and are believed to be patentable for the reasons discussed hereinabove in connection with amended independent claim 13. Reconsideration of the rejection of claims 14-22 and 24-30 is respectfully requested.

Independent claim 31 has been amended similarly to independent claim 13. Accordingly, for the reasons stated hereinabove with regard to claim 13, reconsideration of the rejection of claim 31 is respectfully requested.

Conclusion

For the reasons set forth above, Applicant believes claims 13-22 and 24-31 are patentable over the cited art and are in condition for allowance. Reversal of all of the Examiner's rejections and allowance of these claims are respectfully requested.

Respectfully submitted,

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